

The Strength of Very Soft Clay Reinforced with Singular Bottom Ash Column

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Synopsis: In construction industry, the utilization of by-products or waste is one of the methods to achieve sustainable development. Stone column is a method where some of the soil is being replaced with granular material such as crushed rocks or sand. Stone columns usually installed in soft cohesive soil to improve bearing capacity, reduce settlement, and accelerate the dissipation of pore water pressure. Since the properties of bottom ash are almost similar to sand, there is a potential of using this material as granular material in stone column. By using bottom ash as stone column, generally it will significantly reduce the cost of a project and also solve the disposal problem for bottom ash since the material is considered as waste. In this study, four batches of kaolin samples with undrained shear strength of less than 10 kPa were tested on the shear strength after being inserted with bottom ash column. Each batch produced three specimens, tested to represent specimens without columns, specimens with partially penetrating bottom ash column and specimens with fully penetrating bottom ash column. A total of 12 unconfined compression tests had been conducted on one-dimensionally consolidated kaolin specimens. The specimens used for this test were 50 mm in diameter and 100 mm in height. The diameter for the column was 10 mm and the height of the column chosen for this study was 60 mm and 100 mm. The results show that the shear strength of the specimens was improved with the installation of bottom ash. However, for partially penetrating column, the value of shear strength increased more significantly compared to the fully penetrating column, although the fully penetrating column possessed higher column penetration ratio.

Keywords: bottom ash, stone column, bottom ash column, strength, soft clay.

1. Introduction

To fulfill the human needs to have a place called home to live in and to develop the country to compete economically, we tend to forget that these activities will have negative impacts to the environment. People start to recognize the importance of having an alternative method which still would fulfill the needs of the people but still would not imposed a bad influence on the environment. There is also some urgency in the world today to consider sustainable development in construction industry. People have become conscious of the uncontrollable usage of non-renewable natural material and the production of waste from the construction sector in which these activities will have direct impact on the earth. Among the natural material being used in construction sector is timber, aggregate, sand, concrete, rock and steel. In construction industry, the utilization of by-products or waste is one of the methods to achieve sustainable development. Zainul Abidin [1] stated that the term 'sustainable development' was first introduced in the Brundtland Report in 1987. In Malaysia alone, coal-burning power plants have generated more than 15.5 million tons of coal in 2007 and the value had been predicted to increase to 22.5 million tons in 2010, as coal-burning power plant is the main source of energy in this country (Mahmud [2]). Because of major usage of coal, a lot of waste from coal ash will be produced. Fly ash and bottom ash are two of the coal ashes by-products produced from power generating plants.

Constructions on marginal sites such as soft clay soil require ground improvement or modification technique to improve its properties. There are many available methods to improve the properties of soft clay soil such as sand drain, piling, stone column and many more. Stone column is a method where some of the soil is being replaced with granular material such as crushed rocks or sand. Stone column usually installed in soft cohesive soil to improve bearing capacity, reduce settlement, and accelerate the dissipation of pore water pressure. Since the properties of bottom ash are almost similar to sand (Kumar & Stewart [3]), there is a potential of using this bottom ash as a substitute material in stone column. By